

Pesticides & Insecticides

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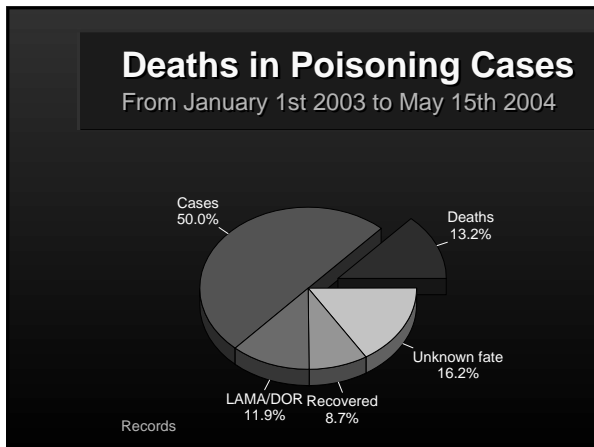
2003

Poisoning cases from January 1st 2003 to May 15th 2004

Type	Allied hospital	DHQ hospital
Rat killers	134	31
Sedatives	278	101
Wheat Pills	638	151
Acid ingestion	55	05
Inebriants (Robbery)	107	61
CuSO4	-	17
Total	1212	366

Age & Sex Distribution
Poisoning cases from January 2003 to May 2004

Age group	Cases	Sex	Cases
10-20 years	655	Males	1247
21-30 years	523		
31-40 years	199		
41-50 years	35	Females	331
51-60 years	99		
61-70 years	33	Total	1578
Total	1578		



Organophosphorus Poisoning

Ancient Awareness

- History records many examples of plagues and efforts to control them
- 1000 BC China Sulfur used as a fumigant to kill bacteria and fungus
- Sulfur is widely used to day, e.g. protecting wine barrels and in wine.

History of Nerve Agents

- Earliest recorded use is by *native tribesmen of Africa* who used *Calabar bean* as *agent* inhibiting cholinesterase.
- In 1864, its active principle was isolated known as *Physostigmine (Eserine)*.
- First organophosphorus ChE inhibitor was *Tetraethyl Pyrophosphate (TEPP)*.

History of Nerve Agents

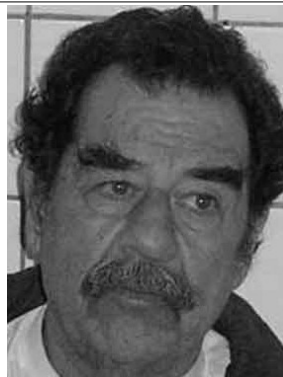
- In 1930s, interest in both physostigmine (reversible) & organophosphorus (irreversible) ChE inhibitors increased.
- Reversible ---- used for intestinal atony, myasthenia gravis & glaucoma.

History of Nerve Agents

- Five Organophosphorus compounds are regarded as Nerve agents:
 - *Tabun (GA)*
 - *Sarin (GB)*
 - *Soman (GD)*
 - *GF*
 - *VX*
- In 1936, *Gerhard Schrader* synthesized tabun & then sarin & handed over to German Defence Ministry

History of Nerve Agents

- Soviet Union _____ USA & UK
- The United States began to produce sarin in the early 1950s, and VX in early 1960s, for potential military use
- During the Persian Gulf War (1990-1991), Iraq believed to have GB & GF
- Sarin has also been used in terrorist attacks



WMD

Pesticides

- Poison gas research in Germany yielded the organophosphorus compounds, the best known of which is *parathion*.
- Further research yielded hundreds of organophosphorus compounds, the most noteworthy being *malathion*.

Pesticides

- Today, some 900 active chemical pesticides are used to manufacture *40,000 commercial* preparations.
- The Environmental Protection Agency (EPA) estimates that the use of pesticides *doubled between 1960 and 1980*.
- Currently, over *372 million kilograms a year are used in the United States, with over 1.8 billion kilograms a year used worldwide*.

Definition - Simple

The function of a pesticide is to kill or harm some form of life.

Definition - EPA

“...a pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.”

“...a pest is any harmful, destructive, or troublesome animal, plant or microorganism.”

US Environmental Protection Agency (EPA)

Classes Of Pesticides

- Insecticides (kill insects)
 - Organochlorines
 - Organophosphates
 - Carbamates
 - Synthetic Pyrethroids
- Herbicides (kill plants)
- Rodenticides (kill rodents)
- Fungicides (kill fungus)
- Fumigants (kill whatever)

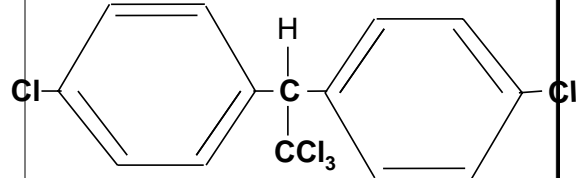
Insecticides

- Insecticides (kill insects)
 - Organochlorines
 - Organophosphates
 - Carbamates
 - Synthetic Pyrethroids

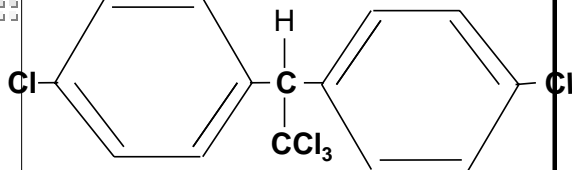
Chlordane

"Chlordane America's leading lawn and garden insecticide. Used extensively by pest control operators for termite control, because of its long lasting effectiveness."

What Is This?



DDT



- Organochlorine insecticide
- 1945 control of mosquitoes
- Effective but very persistent
- Very soluble in fat
- Damaged bird eggs

Rodenticides (kill rodents)

- ❖ Botanicals
 - Red squill – effects heart
 - Strychnine – blocks glycine receptors in spinal cord - convulsions
- ❖ Inorganics
 - Phosphorous – GI track
 - Thallium – hair loss, nervous system
 - Zinc phosphide – GI track
- ❖ Anticoagulants
 - Warfarin – inhibits blood clotting
 - Vacor – newer blood clot inhibitors

Fungicides (kill fungi/mold)

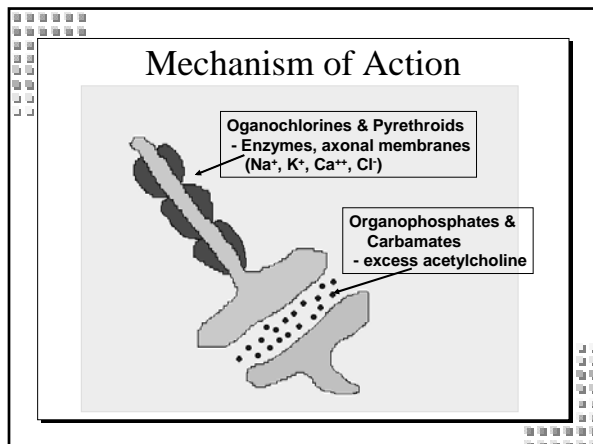
- ❖ Early Examples
 - ❖ Sulfur, copper sulfate
 - ❖ Mercury based compounds
- ❖ Hexachlorobenzene
- ❖ Pentachlorophenol
- ❖ Dithiocarbamates

Routes of Absorption

- Inhalation
- Ingestion
- Dermal absorption

Mechanism of Action

- Inhibition of **Acetylcholinesterase** in nervous system resulting in respiratory, myocardial & neuro muscular transmission impairment



- ### Home Exposure
- ❖ Accidental ingestion
 - ❖ Lawn and garden use
 - ❖ Insect control
 - ❖ Food supply
 - ❖ Water supply

- ### Occupational Exposure
- ❖ Farms & Farm worker
 - ❖ Pesticide applicator
 - ❖ Manufacture
 - ❖ Mixing and handling
 - ❖ Landscapers
 - ❖ Many more

- ### Other Exposure
- ❖ Dietary exposure
 - Pesticide residues on crops
 - ❖ Community exposure
 - Airborne drift from commercial app
 - ❖ Contaminated drinking water
 - Leaching from soils to ground water

- ### Target Organs
- Nervous system
 - Respiratory system
 - Cardiovascular system

- ### Clinical Effects
- Effects caused by excess acetylcholine (*cholinergic syndrome*)
 - 3 groups
 - Muscarinic effect (Parasympathetic overactivity)
 - Nicotinic effect (Sympathetic overactivity)
 - Central nervous system effect

Mild Symptoms

Anorexia	Headache
Dizziness	Weakness
Anxiety	Sub sternal discomfort
Fasciculations of tongue & eyelids	Miosis
Impairment of visual acuity	Lethargy

Moderate Symptoms

Nausea	Salivation
Bronchorrhoea	Lacrimation
Abdominal cramps	Diarrhea
Vomiting	Sweating
Hypertension	Muscular fasciculations

Severe Symptoms

Miosis or mydriasis	Non-reactive pupils
Dyspnoea	Respiratory depression
Pulmonary oedema	Cyanosis
Loss of sphincter control	Convulsions
Coma	Bradycardia
Cardiac ischemia	Hypokelimia
Acute pancreatitis	Muscular paralysis

Nicotinic Effects

- Skeletal muscle weakness & paralysis

Muscrinic Effects

- Bronchospasm
- Bronchorrhoea
- Aspiration
- Bradyarthmias
- Hypotension

Diagnosis

- In the absence of history, it is initially, *clinical*.
- Foul smell (*garlic like*) in breath.
- Clothes contaminated with faeces, vomiting.
- Favorable *response to Atropine* is more useful diagnostic sign.
- *Cholinesterase assay*.

Laboratory Analysis

- Complete blood cell count
- Serum electrolyte levels
- Arterial PH & blood gases
- Liver function tests
- ECG & Chest X-Rays
- *Cholinesterase levels*

Serum Cholinesterase

- Normal value 4500-10500 IU
- Pt. become symptomatic when concentration is below 70%

Differential diagnosis

- Nicotine poisoning
- Drugs
- Pontine Hemorrhage
- Gastroenteritis
- Asthma
- Guillain-Barre syndrome

First Aid Measures & Management

- Chemical be removed as quickly as possible
- *Atropine* to be administered
- Contaminated clothing to be removed
- In skin contact, area to be washed by soap & water.
- First-aid personnel should wear rubber or plastic gloves

First Aid Measures & Management

- In acute respiratory failure, keep airway open & prevent aspiration.
- *Oxygen* to be given.
- In case of ingestion, *Lavage* should be done within 1 hour of ingestion.
- *Activated charcoal* maybe helpful.

Atropine

- Atropine administered *I/V* in doses of 1-2 mg (0.5 mg/kg) every 5 to 10 minutes until signs of **atropinisation**,
 - Dilated & fixed pupils
 - Loss of salivation (dry mouth)
 - Bronchial hypersecretionor complete reversal of symptoms occurs

Atropine

- In very severe cases bolus injections of more than 10 mg may be necessary
- Atropine must be continued to maintain atropinisation until patient recovers

Contrathion (Paralidoxime)

- It is most effective if administered immediately or within 24 hours
- **Adult Dose:**
 - 1-2 gms in infusion of 100 ml saline over 15-20 minutes. Injection speed should not exceed 200 mg/min
 - After one hour second dose is required
 - Maximum dose of 12 gms in 24 hours has been suggested
 - In children, 20-60 mg/kg body weight is suggested

Diazepam

- 5 to 10 mg (0.2 to 0.3 mg/kg) by slow I/V over 3 minutes, maybe repeated every 10 to 15 min (maximum 30 mg) to control convulsions
- Physiotherapy maybe needed for *delayed peripheral neuropathy*

Post mortem findings

- *Externally*, cyanosis is present
- *Internally*,
 - Garlic like or kerosine like smell from stomach
 - Pulmonary oedema
 - Petechial haemorrhages
- Organo phosphorus can be detected in highly decomposed bodies

Complications

- *Intermediate syndrome (IMS)*
- Begin 24-96 Hrs. after the poisoning and after the resolution of a cholinergic phase. Last for 5-32 days.
- Consist of paralysis of proximal limb muscles, neck flexor muscles, respiratory muscles and various motor cranial nerve.

Complications

- *Delayed peripheral Neuropathy*
- 1-5 weeks after exposure
- Neuropathy typically begins with paresthesias and pain followed by ataxia weakness and toe drop.
- It rapidly progress to a flaccid praxis (cf. Guillain-Barre syndrome)
- May progress for 2-3 months and muscle wasting occurs.
- Recovery of motor functions occurs in reverse order in which the functions were lost.

Medico legal Importance

- *Accidental* poisoning of children
- *Occupational exposure* among adult farm workers and secondary accidental exposure to their families can occur
- *Suicide* attempts probably account for more severe and more frequent poisonings

Medico legal Importance

- *Exposure* of the general population through the *consumption of foodstuffs* treated incorrectly with pesticides or harvested prematurely
- *Accidental* poisonings can also occur through failure to observe the safe re-entry time after application.

Medico legal Importance

- *Occupationally exposed populations*
 - Factory workers involved in synthesizing pesticides.
 - Workers involved in formulating and dispensing pesticides.
 - Agricultural spray workers.
 - Crop harvesters during disease vector control periods.
 - Public-health workers involved in vector control.
 - Health workers not following the correct procedures when handling poisoned patients, especially when ventilatory support is needed

Environmental Risks

- 3 routes of entry in water resources
 - Industrial waste or affluent
 - Seepage from buried toxic wastes into water supplies
 - Contamination of running water directly
- Carcinogenic
- Teratogenic
- Mutagenic

Summary

- ❖ Reduce use
- ❖ Reduce Exposure
- ❖ Seek alternatives
 - Integrated Pest Management (IPM)
- ❖ Beware of local and global use